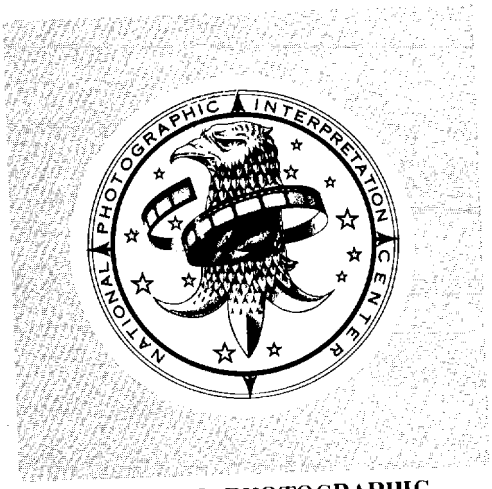

NATIONAL PHOTOGRAPHIC
INTERPRETATION CENTER

TECHNICAL PUBLICATION

TEST AND EVALUATION REPORT

[redacted]

25X1

REAR PROJECTION VIEWER ATTACHMENT FOR THE ZOOM 240 SYSTEM

CONFIDENTIAL

DECLASS REVIEW BY NIMA / DoD

NPIC/R-12/73
MAY 1973

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MAY 1973

Comments and queries regarding this report are welcomed.
They may be directed to [redacted] 25X1
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ABSTRACT

The Rear Projection Viewer (RPV) was tested and evaluated at NPIC between October 1972 and March 1973. Acceptance tests, engineering evaluation, and operational evaluations were conducted within this time period.

This prototype RPV is well constructed, both mechanically and optically. The single instance in which the RPV did not meet the contractual specification did not appear to hamper the PIs in their evaluation of the RPV concept. This concept of monoscopic viewing on the RPV's rear projection screen was generally considered not useful.

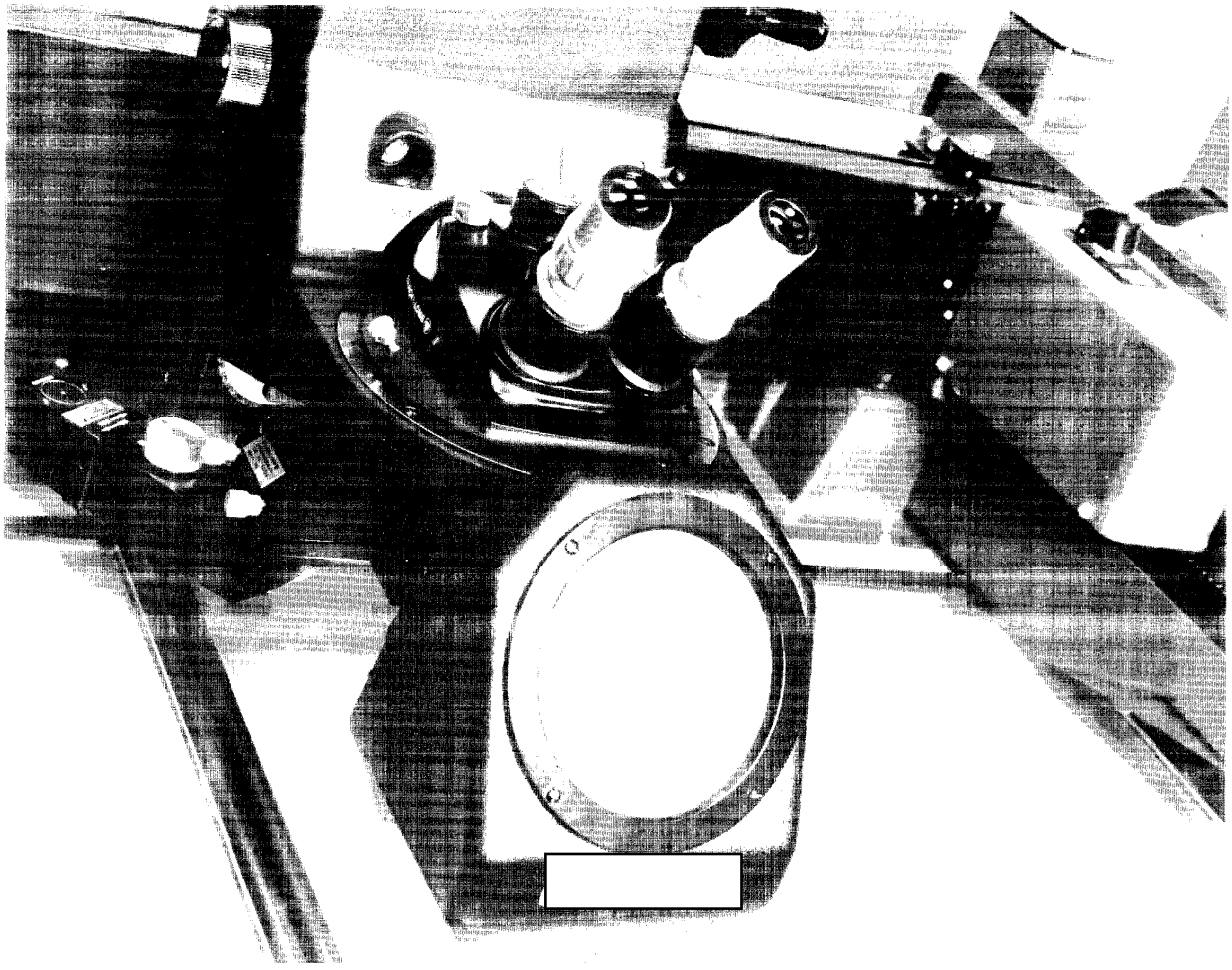

FIGURE 1. RPV ATTACHED TO THE DOVETAIL SLIDE OF A ZOOM 240 MICROSTEREOSCOPE SYSTEM

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[redacted] REAR PROJECTION VIEWER ATTACHMENT FOR THE ZOOM 240 SYSTEM

1. INTRODUCTION

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The [redacted] Rear Projection Viewer, Fig. 1, is an attachment for the Zoom 240 Microstereoscope system. It was received by the Test and Evaluation Branch, ESD/TSG, on 26 October 1972. This completed the delivery of hardware on the Research and Engineering Division's Zoom 240 Improvements contract with

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[redacted] Acceptance testing of the previously delivered [redacted] Rhomboid Viewing Ports was reported in NPIC/TSG/ESD/TEB-066/72 dated 20 October 1972.

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The Rear Projection Viewer is an experimental device intended only to enable evaluation of the concept of monoscopic scanning with a rear projection screen device on a light table. The RPV can be attached to the monoscopic portion of the dovetail slide on a Zoom 240 Microstereoscope system. The RPV requires the high intensity of 15,000 to 25,000 fL which is presently available only from the High Intensity Tracking Light Source (HITLS) light table.

In use, the RPV optics bypasses the Zoom 240 optics and provides 3.8X magnification on a 4.1-inch diameter rear projection screen. Its projection lens is movable to permit normal monoscopic viewing through the Zoom 240. The RPV mounting bracket has a machined recess to hold a neutral density filter in the light path to the Zoom 240 to reduce the 25,000 fL of the HITLS by a factor of 100 for operator safety and comfort.

This report contains acceptance test results, engineering evaluation results, and operational evaluation comments by two of the operating components of [redacted]

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2. SUMMARY OF TEST RESULTS

2.1 Acceptance Tests

o The RPV prototype easily resolves 16 line pairs/mm over the entire 4.1-inch diameter screen.

o The RPV prototype provides a correctly oriented image at a magnification of 3.8X.

o The stereo rhomboid arms do not have to be removed from the Zoom 240 Microstereoscope system to mount and use the RPV prototype.

o The Zoom 240 can be comfortably used in the 1X monoscopic mode when the RPV's optical switch is retracted, provided the 2.0 density unit (d.u.) attenuating filter is in the RPV's filter holder.

o The falloff in brightness from the center of the RPV's screen to the edges ranged from 47 percent to 64 percent. The permissible falloff was 25 percent.

2.2 Engineering Evaluation

o The RPV prototype will not clear commonly used holddown devices when it is in focus.

o Twenty-five thousand fL is inadequate illumination when viewing high density operational imagery that has low contrast.

o The 2X and 0.5X monoscopic objectives cannot be mounted on the Zoom 240 when the RPV prototype is mounted.

o The RPV prototype has no provision for image rotation to adjust for obliquity and/or sun angle.

o The RPV prototype is very well constructed, both mechanically and optically.

2.3 Operational Evaluation

o The RPV requires more illumination than is presently or is expected to be available to PIs at NPIC.

o Most evaluators see no value in the concept of monoscopic scanning with the RPV.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 The RPV met all of the contractual requirements except for the center-to-edge brightness gradient and was judged quite adequate as an experimental device to test a concept.

3.2 The operational evaluation showed only a very mild interest in the concept of monoscopic scanning of film with this rear projection screen. Most participating PIs did not find it beneficial for the tasks they perform.

3.3 The results of the engineering evaluation are that the construction, both mechanical and optical, is quite adequate; that the RPV, when focused, does not clear the old or new film holddown devices: that the 2X stereo lens objectives cannot be used without removing the RPV; and that the screen brightness and contrast is adequate on the HITLS except for low contrast, high density imagery.

3.4 It is recommended that no further implementation of this concept be pursued.

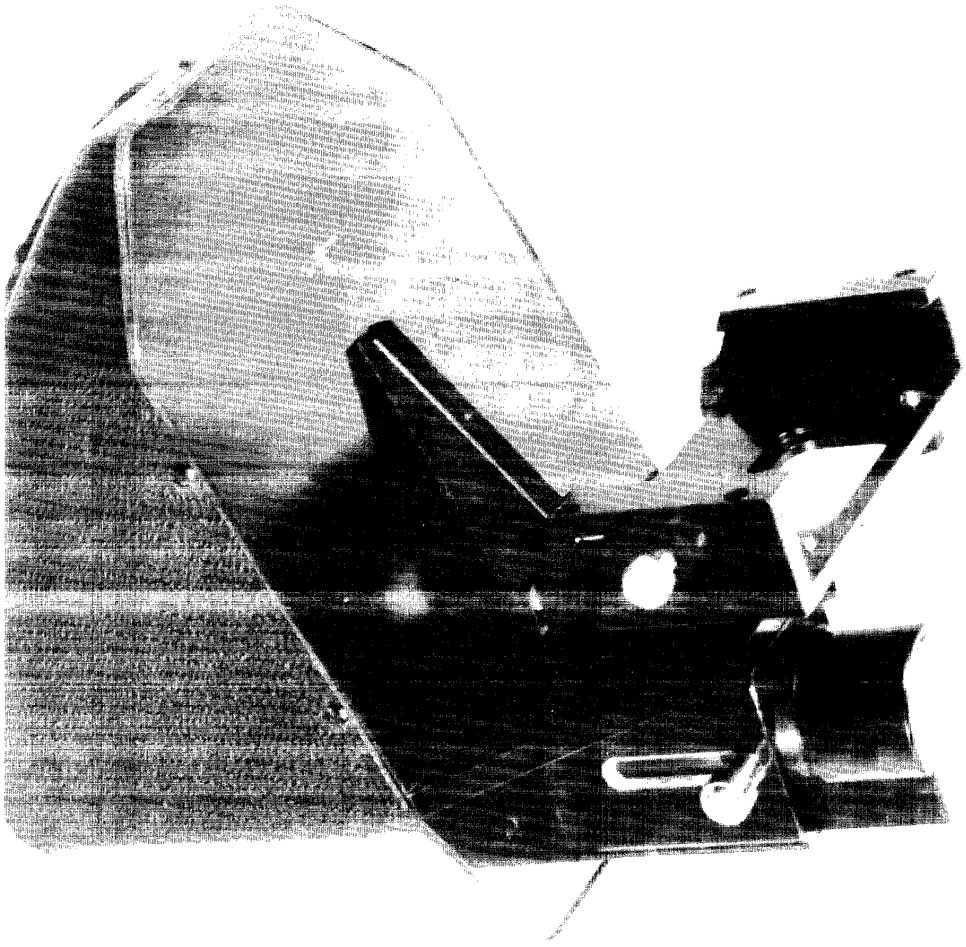


FIGURE 2. REAR QUARTER VIEW OF THE RT WITH OPTICAL SLIDE EXTENDED AND TWO FILTERS

4. DESCRIPTION OF EQUIPMENT

The RPV prototype, Fig. 1, features a 4.1-inch diameter rear projection screen. A 3-inch focal length Super Baltar lens and roof prism are mounted on a mechanical slide in the RPV. In the extended position, the roof prism intercepts the light rays that would go to the Zoom 240 in the monoscopic mode. The Super Baltar lens projects the image onto the screen at 3.8X magnification with 16 line pairs/mm resolution or better. A light table providing about 25,000 fL is required. When the slide is in the retracted position, the light rays pass to the Zoom 240, impeded only by whatever filter may be in the filter holder of the RPV. Figure 2 shows the mechanical slide in the extended position, the filter holder cutout in the shelf above the slide, and the 2.5 and 2.0 d.u. neutral density attenuating filters lying to one side of the RPV.

5. TEST DETAIL

5.1 Acceptance Tests

Optical Resolution

The RPV shall be capable of resolving 16 lines per millimeter at the film plane.

Test Method - The HITLS light table was set at 25,000 fL. USAF 1951 pattern resolution targets of high, medium, and low contrast and of both polarities were successively placed on the light table.

Conclusion - The RPV easily meets the requirement over the entire screen. The resolution was 16 line pairs/mm or better.

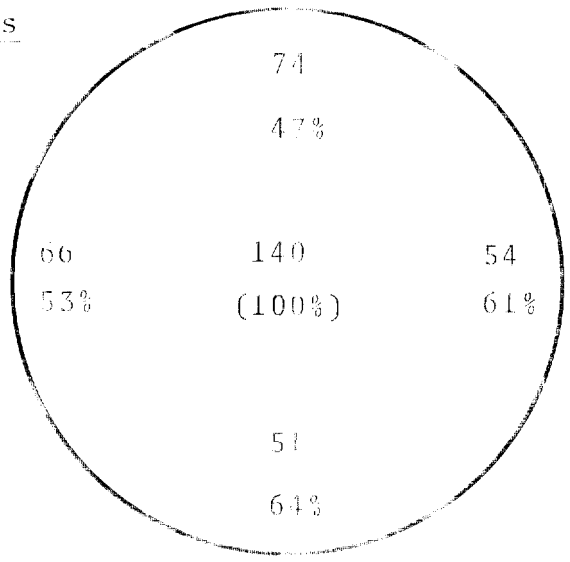
Brightness Gradient

The maximum linear brightness gradient shall not exceed 25 percent between any two measurements on the screen.

Test Method - The brightness measurements were made with the CM-13 microscope head and the United Detector Technology Model 11A photometer (S/N 80016). The HITLS was scanned to optimize each light reading.

Test Results

Relative light readings and percent falloff



Conclusion - The RPV does not meet the requirement.

Optical Magnification

The magnification is listed as 4X.

Test Result - The magnification is 3.8X.

Conclusion - The RPV meets the requirement of a nominal 4X magnification.

Rear Projection Screen Diameter

The screen diameter is listed as 4 inches.

Test Result - The diameter is 4.1 inches.

Conclusion - The RPV meets the requirement of a nominal 4-inch screen diameter.

Image Orientation

The RPV shall be constructed so as to provide an "erect" image, by which it is meant that the image appears as it would if the light table were tilted into the plane of the screen.

Conclusion - The RPV meets this requirement.

Mechanical Features

The RPV will slip over the edges of the Zoom 240 dovetail slide and be held on with a compression screw.

The RPV objective lens will be movable to permit viewing of the image through the Zoom 240 in mono with no add-on objectives.

The stereo rhomboid arms should not have to be removed from the Zoom 240 to use the RPV.

Conclusion - The RPV fulfills all three of these requirements.

Safety

Provision will be made for an attenuating filter to be used to protect the operator's eyes from the intense light source (25,000 fL from the HITLS) when viewing the image through the Zoom 240.

Test Result - Two neutral density filters were provided of 2.0 and 2.5 density units. The RPV fitting that clamps onto the dovetail of the Zoom 240 has a machined recess to hold either neutral density filter in the optical path of the Zoom 240 in the monoscopic viewing mode. It was observed that the 2.0 density unit filter was sufficient to reduce the light intensity through the Zoom 240 eyepieces to the level seen on the screen of the RPV.

Conclusion - The RPV easily meets this requirement.

5.2 Engineering Evaluation

Screen Brightness and Contrast

The brightness and contrast appear very good with good quality imagery on the HITLS light table at 25,000 fL. When viewing low contrast, high density film, however, the image contrast on the RPV screen appears adequate only in a darkened room, and the image brightness appears inadequate even in a darkened room.

Physical Compatibility

The bottom of the RPV, when in focus, will clear neither the 1/2-inch-thick holddown rings previously used by IEG nor the new 0.225-inch-thick green plastic holddown devices. The RPV case extends to within 0.213 inches of the light table when focused, and two screw heads extend down even closer.

The RPV can be used without removing the B&L stereo rhomboid arms (Cat. #537028). The 1X stereo lens objectives (Cat. #537030) can be used on the rhomboid arms without removing the RPV. This is not the case for the 2X stereo lens objectives because their short working distance requires focusing so close to the table that the RPV contacts the table surface.

The Zoom 240 can be used in the 1X monoscopic mode without removing the RPV. The 0.5X and 2X monoscopic objectives cannot be mounted on the Zoom 240, however, without removing the RPV.

Image Rotation

The RPV does not have provision for image rotation. Therefore, the observer has to accept the obliquity (panoramic photography) and sun angles present on the web of film or physically rotate the Zoom 240 pod to rotate the RPV. The observer will then have to twist his head and/or body if he wishes to view the screen at normal incidence. Of course, this is similar to what a PI has to do when using a tube magnifier.

Construction

The RPV appears to be generally well constructed, both mechanically and optically. The slide holding the projection lens moves easily in one direction but tends to "snap" in the other direction. There is no provision to hold the safety filter in place when the dismounted RPV is tilted more than 90 degrees. As an experimental device to test a concept, however, the RPV seems quite adequate.

5.3 Operational Evaluations

The RPV was delivered to each operating component on a light table capable of giving 25,000 fL at the film plane. TEB provided a suggested questionnaire and a copy of the TEB Acceptance Test Report that pointed out the experimental nature of this prototype device.

One operating component conducted a 2-week evaluation. They stated that the magnification level and field of view are too small. They also referred to the fact that the RPV requires more illumination than their standard light tables are able to provide. Most of their evaluators felt that the naked eye could do a better job.

A second operating component had more mixed reactions after four of their PIs evaluated the RPV for about 8 hours

each. In response to the question, 'Are you in favor of the idea of having a screening device as an aid for image exploitation work?' two PIs were conditionally in favor of the RPV and the other two were not. The conditions were 1) that it be provided only in a voluntary role and 2) so long as the stereo microscope is still available.

A third operating component has decided to not complete their operational evaluation because they do not plan to acquire the high intensity light source light table that is required.

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